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The genus *Trichosanthes* (Cucurbitaceae) in Sabah

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Summary. An account of the 21 *Trichosanthes* species occurring in Sabah is given. One new section (sect. *Asterosperma*), four new species (*T. adhaerens, T. fusca, T. intermedia, T. postarii*) and one new subspecies (*T. montana* subsp. *crassipes*) are described.

Trichosanthes is an essentially SE Asian genus, ranging from India and China to Australia. It is the largest genus in Cucurbitaceae with some 100 species world-wide. Some species have medicinal properties. Among the Asian Cucurbitaceae, it is easily recognized by having conspicuously fimbriate petals. They share this character with *Hodgsonia*, a related genus, quite distinct by having large fruits with few large seeds. In *Trichosanthes* the fruits are mostly smaller, with numerous smaller seeds. The shape and size of the seeds are very varied and characteristic for most species, and they serve in the definition of sections.

Since the publication of the conspectus of *Trichosanthes* in Malesia (Rugayah & W.J. de Wilde 1999) and the taxonomic revision of the genus in Malesia (Rugayah 1999), recent exploration for Cucurbitaceae in species-rich Sabah has revealed four new species and one new subspecies (here described) and additions to insufficiently known species. In Borneo, 26 species are known; 21 are accepted for Sabah, of which seven are endemic. Two of the species, *T. auriculata* and *T. wawrae*, which material have been seen from Sabah is doubtful. The 21 species are enumerated in this paper, preceded by two keys to the species, one for male flowering and one for female flowering and fruiting material. For descriptions, except for those of the newly described species, see Rugayah & de Wilde (1998, 1999) and Rugayah (1999).

The remaining *Trichosanthes* species occurring in Borneo, but not or not yet found in Sabah, are *T. cucumerina* L. var. *cucumerina* (widespread in SE Asia); *T. ellipsoidea* Merr. (Sarawak and Philippines); *T. longispicata* Rugayah (Sarawak and possibly Kalimantan); *T. refracta* C.H. Yueh & L.Q. Huang (a peat swamp species of Sarawak, Brunei, Philippines); and *T. tricuspidata* Lour.(widespread in W Malesia).

A NOTE ON *TRICHOSANTHES* SECTIONS IN SABAH

The division into sections is still problematic and follows largely Rugayah & de Wilde (1999) and Rugayah (1999). Provisionally, for the Malesian area, five sections were accepted, of which one, sect. *Edulis* Rugayah, is confined to New Guinea. The other four sections apply to Sabah. As discussed by Rugayah (1999), a tentative result of the evaluation of the Malesian species and proposals concerning the subdivision of the genus *Trichosanthes* by Yueh & Cheng (1974), Jeffrey (1980) and Huang *et al.* (1997, 1998) is available. The characters used for sectional distinction are (1) shape and structure of the seed, (2) colour of the fruit pulp, (3) presence of probract, and (4) size and shape of the male bract. A reconsideration of the content of the sections as defined by Rugayah & de Wilde (1999) has urged the present authors to allocate the species *T. auriculata*, *T. postarii*, and *T. fusca* into the newly proposed section *Asterosperma* W.J. de Wilde & Duyfjes.

As can be seen from the keys to species, they very much key-out to conform to the sections.

1. Section **Trichosanthes** L. Type: *T. cucumerina* L., a widespread species.
Seeds flat, margin broad with undulating edge. Fruit pulp orange-red. Probract absent. Male bracts minute, caducous. One species: *T. cucumerina*.

2. Section **Asterosperma** *de Wilde & Duyfjes* **sect. nov.** *A Trichosanthi sectionibus ceteris in laminis basi auriculatis, seminibus planis in circumferentia circularibus margine late radiate costato differt. Typus: Trichosanthes postarii W.J. de Wilde & Duyfjes.*
Seeds flat, circular in outline, with broad radiating ribbed margin. Fruit pulp whitish, fibrous, acrid. Probract absent. Male bracts linear. Leaf base auricled. Three species: *T. auriculata*, *T. fusca* and *T. postarii*.
Note. Although the fruits of *T. fusca* are unknown, the vegetative similarity amongst the three species is such that its inclusion in this section is very likely. Future study may warrant the rank of a separate new genus for this section.

3. Section **Cucumeroides** (Gaertn.) Kitam. Type: *T. cucumeroides* (Ser.) Maxim. = *T. ovigera* Blume, a widespread species.
Seeds tumid. Fruit pulp whitish, pinkish or orange. Probract absent. Male bracts small, narrow. Five species, divided into two subsections:
subsect. **Cucumeroides**. One species: *T. ovigera*.
subsect. **Tetragonosperma** (C.Y. Cheng & C.H. Yueh) Rugayah. Four species: *T. adhaerens*, *T. beccariana*, *T. mucronata* and *T. pendula*.

4. Section **Foliobracteola** C.Y. Cheng & C.H. Yueh. Type: *T. kirilowii* Maxim. (from China).
Seeds flat, broadly (but faintly) margined. Fruit pulp creamy, sweet taste. Probract in *T. villosa* absent. Male bracts large. One species: *T. villosa*.

Note. With Rugayah & de Wilde (1999) and Rugayah (1999), this section contained four species in Malesia. However, *T. auriculata* is now placed in section *Asterosperma* (see above), and the position of the other two species (not occurring in Sabah) is doubtful.

5. Section **Involucraria** (Ser.) Wight. Type: *T. wallichiana* (Ser.) Wight (from India).
Seeds flat, not or hardly margined. Fruit pulp green-black, acrid. Probract present. Male bracts medium or large. Eleven species, divided into two subsections:
subsect. **Involucraria**. Leaves simple. Nine species: *T. borneensis*, *T. montana* subsp. *crassipes*, *T. globosa*, *T. intermedia*, *T. kinabaluensis*, *T. obscura*, *T. pubera*, *T. quinquangulata* and *T. sepilokensis*.
subsect. **Pedatae** (C.Y. Cheng & C.H. Yueh) S.K. Chen. Leaves foliolate. Two species: *T. elmeri* and *T. wawrae*.
Note. The division of *Trichosanthes* into sections, as well as, section *Involucraria* into subsections seems artificial. The main character, the foliolate leaves of subsect. *Pedatae* is feeble and only holds for the majority of adult specimens. A lesser part of the specimens has (at least partially) simple (entire or lobed) leaves. As is explained under *T. intermedia* (subsect. *Involucraria*), this species has much in common with *T. wawrae* (possibly in Sabah) and with *T. elmeri*, the latter two belonging in subsect. *Pedatae*.

It can be noted that at present *T. kinabaluensis* and *T. quinquangulata*, in subsect. *Involucraria*, have chisel-shaped pointed seeds which is characteristic for these two species only. We have refrained from an alternative division into subsections of sect. *Involucraria* pending more field study and collecting.

KEYS TO *TRICHOSANTHES* SPECIES IN SABAH

1. Key for male flowering specimens.

1. Plant (sub)annual; monoecious. Corolla *c.* 3 cm diam.; bracts 1 mm long only, often fugacious. Cultivated ..... **5. *T. cucumerina*** var. ***anguina***
   Plant (sub)perennial; usually dioecious. Corolla *c.* 3 cm diam. (*T. fusca, T. postarii*) or more; bracts larger, sometimes fugacious 2

2. Leaf base in adult plants with two shallowly concave auricles, each inside with crowded small glands 3
   Leaf base without auricles 5

3. Inflorescences between the leaves. Leaves glabrous or scabrous, hairs 1 mm long or less 4
   Inflorescences far below the leaves. Leaves scabrid, with scattered hairs *c.* 2 mm long ..... **16. *T. postarii***

4. Inflorescences stout, 10–20 cm long, short pubescent. Leaves early glabrescent, hairs minute. Doubtful in Sabah ..... **2. *T. auriculata***
Inflorescences short, few-flowered, slender, *c.* 2 cm long, conspicuously brown hairy. Leaves scabrid hairy ..... **7. *T. fusca***

5. Leaves conspicuously densely hairy, hairs more than 1 mm long; leaf apex long mucronate 6
Leaves (sparsely) hairy, or glabrous, or scabrous, hairs less than 1 mm long; leaf apex mucronate (*T. pendula*) or not 7

6. Tendrils below point of branching 2–2.5 cm long. Male bracts large, broad, 20 mm long or more ..... **20. *T. villosa*** subsp. ***villosa***
Tendrils below point of branching 2.5–6 cm long. Male bracts narrow, 1–2 mm long .... **12. *T. mucronata***

7. Stem green, sharply (4–)5-ribbed. Inflorescences mostly far below the leaves, usually compound, pendant ..... **15. *T. pendula***
Stem angular, striate, ribbed, grooved, or terete; if sharply ribbed, then reddish. Inflorescences among the leaves, patent or erect 8

8. Rachis of raceme 1–1.5(–2) mm thick 9
Rachis of raceme stouter, 2–10 mm thick 11

9. Part of pedicel persisting after anthesis, 5 mm long or less. Tertiary venation abaxially not or with little projecting ..... **14. *T. ovigera***
Persisting part of pedicel much longer than 5 mm. Tertiary venation abaxially much raised 10

10. Plants flowering on freely climbing branches. Leaves short-hairy, hairs less than 1 mm long. Corolla tube *c.* 15 mm long ..... **3. *T. beccariana***, with 2 subspecies
Plants flowering on branches tightly adhering to the substrate by adhesive discs at the apices of the tendrils. Leaves coarsely and roughly hairy, hairs *c.* 2 mm long (Fig. 1). Corolla tube *c.* 20 mm long ..... **1. *T. adhaerens***

11. Most leaves of adult plant compound, 3–5-foliolate 12
All leaves simple, unlobed or variously (deeply) lobed 13

12. Stout climbers ..... **6. *T. elmeri***
Small climbers ..... **21. *T. cf. wawrae forma wawrae***

13. Bracts rather narrow, *c.* 10 mm long ..... **9. *T. intermedia***
Bracts comparatively broader, (10–)15 mm long or more 14

14. Bracts almost wholly deeply and finely wedge-shaped incised ..... **13.** ***T. obscura***
Bracts coarsely dentate or incised in the upper part, or entire 15

15. Tendrils simple. Blade base cuneate, gradually passing into the petiole ..... **8.** ***T. globosa***
Tendrils branched. Blade base cordate, abruptly passing into the petiole 16

16. Bracts entire ..... **18.** ***T. quinquagulata***
Bracts (coarsely) dentate or incised 17

17. Stem distinctly angled, reddish tinged. Probract oblong-lanceolate. Petal fringes reddish 18
Stem ± grooved, not angled, green. Probract proportionally broader. Petal fringes white 19

18. Stem sharply angled. Leaves glabrous (scabrous) beneath ..... **10.** ***T. kinabaluensis***
Stem not sharply angled. Leaves finely pubescent beneath ..... **17.** ***T. pubera***

19. Rachis of raceme 2–5 mm thick ..... **4.** ***T. borneensis***
Rachis of raceme 5–10 mm thick 20

20. Leaves of adult plant unlobed or ± shallowly 3-lobed ..... **19.** ***T. sepilokensis***
Leaves of adult plant deeply 5(–7)-lobed ..... **11.** ***T. montana*** **subsp.** ***crassipes***

2. Key for specimens with female flowers or ripe fruits.

1. Plant (sub)annual; monoecious. Corolla small, *c.* 3 cm diam. Fruit much elongated; fruit pulp orange-red. Seeds flat with widely undulating margin. Cultivated ..... **5.** ***T. cucumerina*** **var.** ***anguina***
Plant (sub)perennial; usually dioecious. Corolla mostly more than 3 cm diam. Fruit (sub)globose, ovoid, or ellipsoid; fruit pulp cream, pink, or green black. Seed various, without undulating margin 2

2. Leaf base with two shallow auricles, each with crowded small glands. [Fruit pulp ± white. Seeds flat, subcircular, with broad radiately structured margin] 3
Leaf base without auricles 4

3. Fruit on stout racemes in leafy branches. Leaves glabrescent. Doubtful in Sabah ..... **2.** ***T. auriculata***
Fruit on short slender peduncles, far below the leaves. Leaves with sparse coarse hairs ..... **16.** ***T. postarii***
Fruit not known. Leaves scabrid hairy ..... **7.** ***T. fusca***

4. Seeds tumid, with the two faces much inflated. Fruit pulp creamy or pinkish 5
Seeds flat, without inflated sides. Fruit pulp either cream-coloured and sweet, or green-black and bitter 9

5. Leaves densely soft hairy, apex long-mucronate (mucro 10–25 mm long). Fruit ovoid-ellipsoid, green and white-striped when ripe; pulp creamy ..... **12. *T. mucronata***
Leaves sparsely or densely short-haired, or glabrous (glabrescent), or scabrous, apex blunt or acute, or mucronate (mucro up to 10 mm). Fruit various, green or orange-red, stripe 6

6. Stem sharply ribbed. Fruit one or few in pendant infructescences, mostly situated far below the leaves, yellow-green and white-striped when ripe; pulp creamy. Leaf apex mucronate ..... **15. *T. pendula***
Stem round, angular, or grooved, not sharply ridged. Fruit solitary or in short racemes among the leaves, only pendent when mature, and turning orange and paler flamed when ripe; pulp pinkish (always?). Leaf apex blunt or acute 7

7. Lower leaf surface mostly finely pubescent along the areoles defined by slightly raised tertiary venation. Fruit pulp not fibrous ..... **14. *T. ovigera***
Lower leaf surface finely or coarsely hairy, tertiary venation distinctly raised. Fruit pulp fibrous (not known in *T. adhaerens*) 8

8. Plant flowering on freely climbing branches. Leaves short-hairy, hairs less then 1 mm long ..... **3. *T. beccariana*** with 2 subspecies
Flowering branches slightly adhering to the substrate. Leaves rough-hairy, *c.* 2 mm long (Fig. 1). Fruit not known ..... **1. *T. adhaerens***

9. Leaves densely villose. Fruit yellow-green when ripe, pale flamed; pulp sweet, creamy; seeds flat, with broad margin ..... **20. *T. villosa*** subsp. ***villosa***
Leaves sparsely short-hairy, glabrous (glabrescent) or scabrous. Fruit orange-red when ripe (yellow in *T. globosa*); pulp green-black, acrid; seeds flat, without or with narrow margin 10

10. Leaves of adult plant compound, 3–5-foliolate. Fruit ovoid-ellipsoid; seeds (broadly) ellipsoid or almost circular 11
Leaves of adult plant simple, unlobed or (deeply) lobed. Fruit ovoid-ellipsoid or globose; seeds ellipsoid-oblong 12

11. Fruit 12–20 cm long ..... **6. *T. elmeri***
Fruit (not seen from Sabah) shorter, 6.5–8 cm long ..... **21. *T.*** *cf.* ***wawrae forma wawrae***

12. Fruit longer than wide, ovoid or ellipsoid. Leaves unlobed or variously lobed, including as deep as to the base 13
Fruit (sub)globose. Leaves unlobed or lobed, never as deep as to the base 14

13. Stem green, not ridged. Leaves scabrid ..... **9. *T. intermedia***
Stem reddish, ridged. Leaves abaxially pubescent ..... **17. *T. pubera***

14. Seeds with chisel-shaped base 15
Seeds with truncate or rounded base 16

15. Fruit uniformly red; fruiting pedicel often curved. Stem green, ± grooved. Lowland up to 1000 m ..... **18. *T. quinquangulata***
Fruit orange-red with paler distinct flecks; fruiting pedicel straight. Stem purplish, angular. Montane, in Mount Kinabalu area ..... **10. *T. kinabaluensis***

16. Fruiting pedicel 5–8(–10) mm thick 17
Fruiting pedicel 10–20 mm thick 18

17. Fruiting pedicel uniform in structure and colour throughout ..... **13. *T. obscura***
Fruiting pedicel consisting of a striate basal part and a smooth red upper part passing into the red fruit ..... **4. *T. borneensis***

18. Fruit yellow (always?); pulp green. Tendrils simple ..... **8. *T. globosa***
Fruit ± (orange-)red, pulp green-black. Tendrils branched 19

19. Fruit (orange-)red, pedicel smooth or shallowly fissured. Leaves unlobed or shallowly 3-lobed, ... **19. *T. sepilokensis***
Fruit bright red, pedicel conspicuously corky, grooved. Leaves deeply 5–7-lobed .....
..... **11. *T. montana* subsp. *crassipes***

ENUMERATION OF SPECIES

1. Trichosanthes adhaerens *W.J. de Wilde & Duyfjes* **sp. nov.** *Trichosanthi beccarianae subsp. pusillae similis, caule florenti ad substrato adhaerenti, pilis grossioribus 1–2 mm longis, floribus masculis maioribus receptaculi tubo c. 3 cm longo differt. Typus: Lim, Postar & Markus SAN 143273, Sipitang, Ulu Sungai Padas, lower eastern slope of Ruan Watgerano, Sg. Melabid, (holotypus SAN; isotypus L).*

(Fig. 1 A–G')

Climber, a few meters high, clinging to rotten tree trunk; dioecious; wholly green-white harshly pubescent, hairs 1–2 mm long; plant green on drying; cystoliths not seen; fertile stem 2–4 mm diameter. Probract absent. Tendrils hairy, 5–6-branched, 1 single branch at 0.5(–1) cm from the base and 4 or 5 branches at 1.5–2.5 cm from the base, branches 2–3 cm long, ending in adhesive discs, *c.* 2 mm diameter, finely warty and hairy. Leaves scabrid, coarsely and roughly hairy (hairs 2 mm long), simple, shallowly or deeply 3(–5)-lobed,

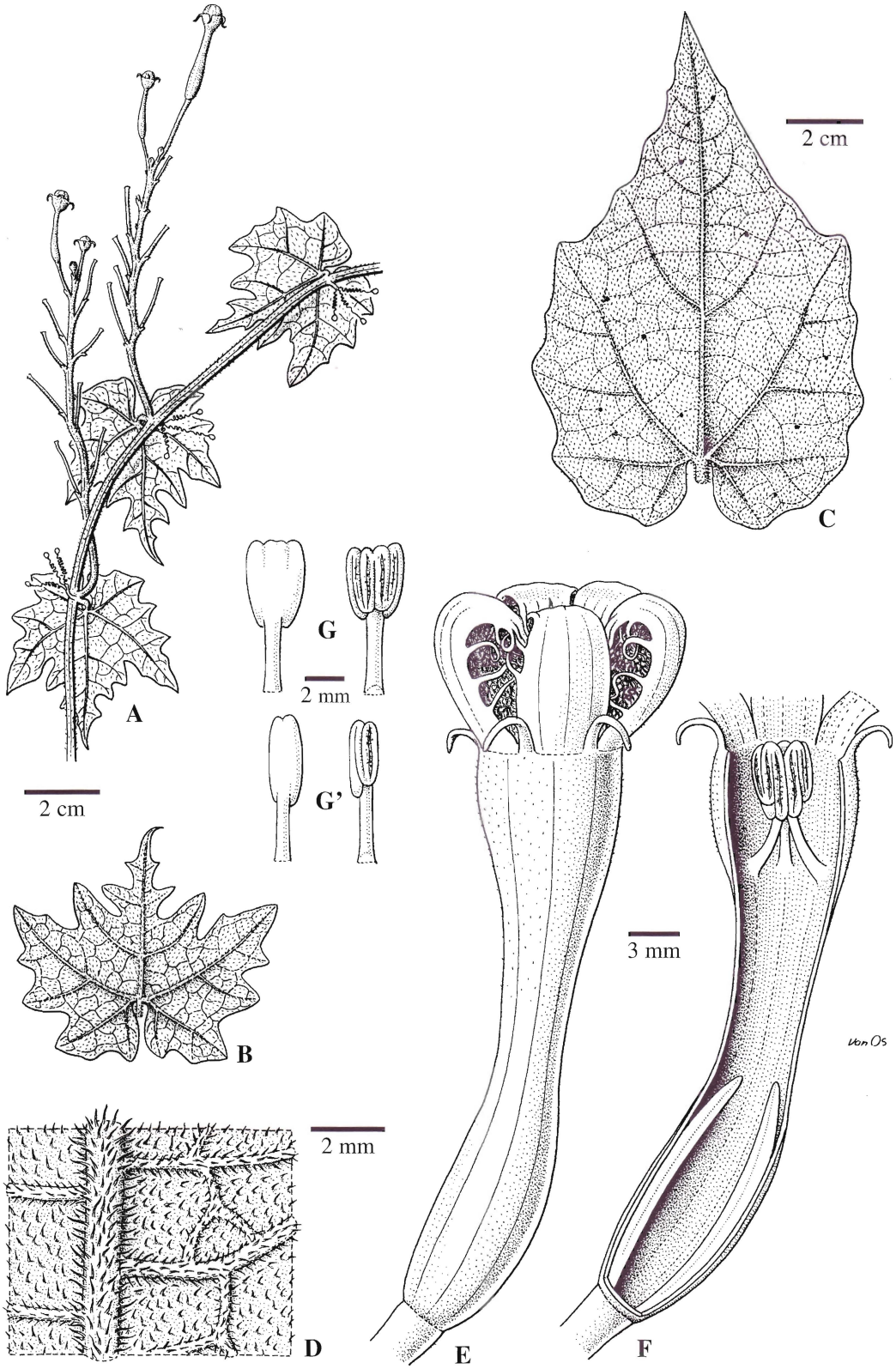

Fig. 1. *Trichosanthes adhearens*. **A.** Male flowering leafy twig. **B.** & **C.** Leaves. **D.** Detail of lower leaf surface. **E.** Male flower. **F.** Male flower, opened, showing disc elements and stamens. **G.** Stamen, 2-thecous. **G'.** Stamen, 1-thecous. All from *Lim, Postar & Markus* SAN 143273 (type). Drawn by Jan van Os.

broadly ovate or circular in outline, 4–12 × 4–8 cm, margin coarsely lobulate-dentate to *c.* 1 cm deep, base deeply cordate, apex acute-acuminate, 2–4 mm long mucronate; ad- and abaxially with scattered minute glands of different size, *c.* 0.5 mm diam; basal nerves (3–)5; petiole short. Male raceme erect, unbranched, 4–8 cm long; peduncle 1.5–2 cm long, 1–1.5 mm thick; rachis not thickened, with 8–10(–15) flowers; bracts to 2 mm shifted upwards on the pedicel, elliptic-oblong, 1–2 mm long, margin entire, caducous; glands absent. Male flower pedicel straight, 10–12 mm long, persistent, thickened and somewhat longer (*c.* 15 mm) when perianth is shed; perianth seemingly glabrous, but minutely soft-hairy; receptacle-tube faintly curved, slightly constricted in the middle, throat somewhat dilated, *c.* 30 mm long, *c.* 8 mm wide at apex, inside glabrous, at base with 3 hard-carnose disc elements partly connate with the tube, apex free, *c.* 15 × 2.5 mm; sepals linear, ± recurved, *c.* 5 mm long, margin entire; petals ± elliptic, *c.* 15 mm long, threads fine, 10(–15) mm long; synandrium *c.* 4 × 3 mm, not exserted; filaments slender, *c.* 4 mm long, glabrous. Female flowers and fruits not known.

DISTRIBUTION. Endemic to Borneo (Sabah), so far known only from the type.

HABITAT. Open disturbed area in lower montane oak-chestnut forest. Flowering in April.

SPECIMEN EXAMINED—BORNEO. SABAH: Sipitang, Ulu Sungai Padas, lower eastern slope of Ruan Watgerano, Sg. Melabid, *Lim, Postar & Markus* SAN 143273.

This species is close to *T. beccariana*, especially to subsp. *pusilla*, but differs in having leaves with shorter hairs, smaller male flowers and *c.* 15 mm long receptacle-tube. A structure resembling leaves which is appressed to the substrate in climbing-up juvenile forms are usual in *Trichosanthes*; the flowering in this life form is probably typical for *T. adhaerens*. Differences with *T. beccariana* subsp. *pusilla* are illustrated in Figs. 1 and 3.

Notes. Flower bud deep green, petals light yellow with green stripes. Leaves coriaceous, bullate, dark green.

2. *Trichosanthes auriculata* Rugayah in Rugayah & W.J. de Wilde, Reinwardtia 11, 3 (1998) 216; Rugayah & W.J. de Wilde (1999) 251; Rugayah (1999) 159, pl. 21. Type: *Chai* S 36193, Sarawak (holotype L; isotypes K, L, SAR).

(Fig. 2 A–I)

DISTRIBUTION. Borneo (Sarawak, Sabah (one collection is doubtful, see below), W, C, and E Kalimantan).

HABITAT. Forest edges and recently disturbed places, up to 600 m altitude. Flowering & fruiting throughout the year.

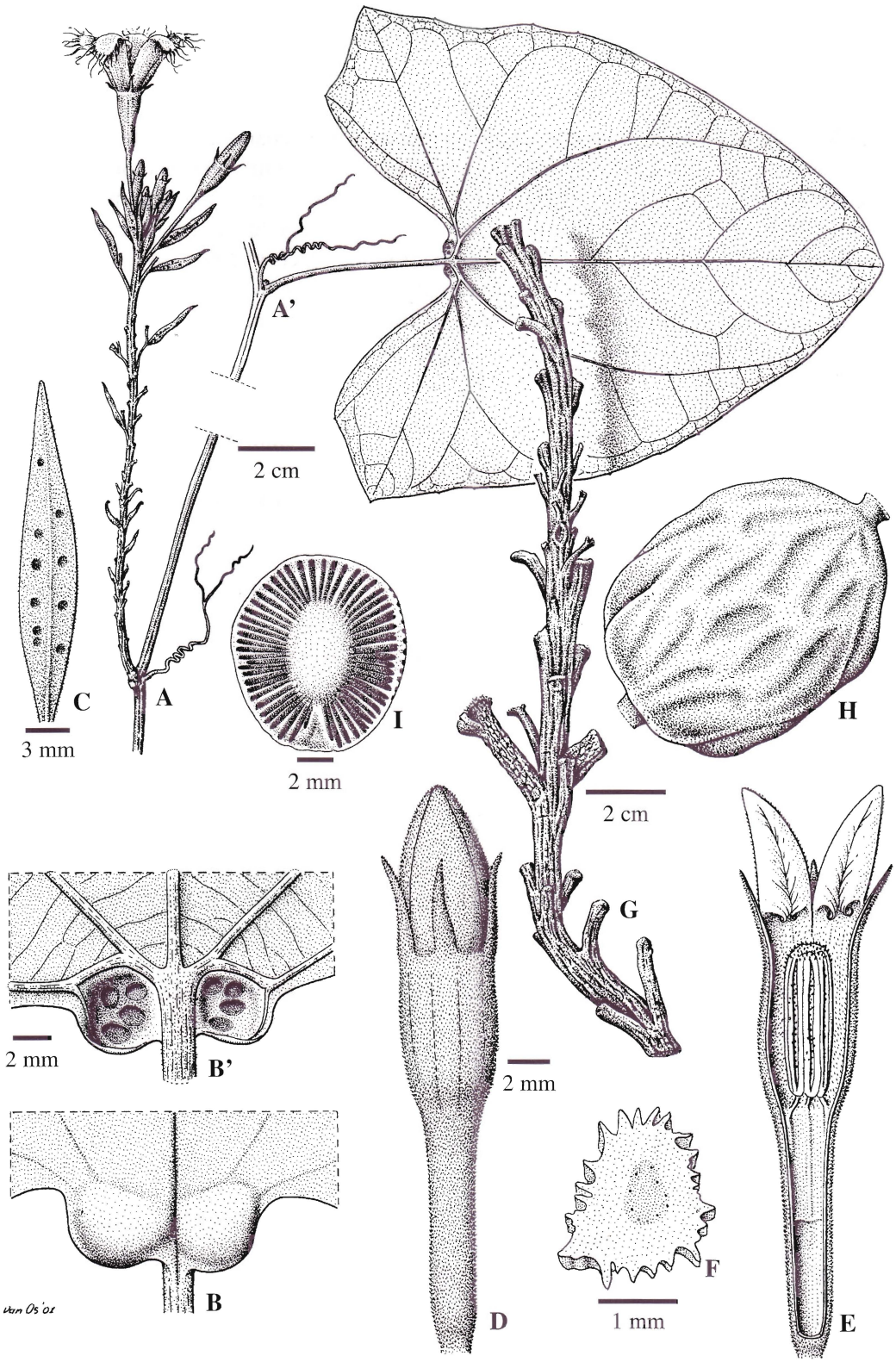

Fig. 2. *Trichosanthes auriculata*. **A.** & **A.'** Male flowering leafy twig. **B.** & **B'.** Base of leaf blade showing auricles, note glands on lower surface. **C.** Male bract. **D.** Male flower bud. **E.** Male flower bud, opened showing synandrium. **F.** Synandrium, cross section. **G.** Infructescence. **H.** Fruit. **I.** Seed. A–F from *Church, Mahyar, Indah, Ismail & Hamzah* 702; G–I from *Chai* S 36193 (type). Drawn by Jan van Os.

SPECIMENS EXAMINED—BORNEO. SABAH: *J. & M.S. Clemens* 27529 (based on a fruit apparently erroneously mounted on a sheet of *Baijiania borneensis* (BO); *Sumbing Jimpin* SAN 136768 (SAN).

The male flowers of *T. auriculata* were up to now not described. For comparison with *T. fusca* and *T. postarii*, together forming section *Asterosperma*, the description is given here: Male flower: pedicel slender, 10–20 mm long, persistent or caducous; receptacle-tube 18–27 mm long, of which the apical portion is widest at 6–7 mm long, 5-ribbed, at throat *c.* 5 mm wide, lower portion tapered to the base, inner surface of the portion above the diaphragm (see below) sparsely hairy, below the diaphragm glabrous; sepals linear-lanceolate, 4–7 mm long, entire; petals in bud folded, forming an 8–12 mm long elongate body, at anthesis obovate, 15–22 mm long, excluding the 7–10 mm long threads; synandrium included, 6–7.5 × *c.* 2.5 mm; filaments 1–1.5 mm long, glabrous, inserted at *c.* 1/3 of the tube below the throat, each continuing down the tube into a thickened rib ending in a shallow 3-lobed ring (diaphragm) situated about halfway the narrowed basal part of the tube; thecae fused dorsally in the upper half only.

The limited material available suggests that this species is dioecious. There is one collection of a twig with male racemes and a detached fruit, and one other collection with stout racemes with 2 fruits and numerous persistent pedicels possibly of male flowers. The elongate shape of the folded petals in male buds and the habit of creeping and rooting on the nodes are reminiscent of the genus *Gymnopetalum*. *Clemens 21110* (doubtful while sterile) and *Kato et al. 11279* (type of *T. fusca*), both mentioned under *T. auriculata* by Rugayah & de Wilde (1999) are now relegated to *T. fusca* (see there).

3. *Trichosanthes beccariana* Cogn. in A. & C. DC., Monogr. Phan. 3 (1881) 380; Rugayah & W.J. de Wilde (1999) 251; Rugayah (1999) 77. Lectotype (Rugayah 1999): *Beccari* 802 bis, W Sumatra (holotype FI; isotypes K, MEL).

a. subsp. ***beccariana***; Beaman *et al.* (2001) 210.

DISTRIBUTION. West C Sumatra, Borneo (Sabah).

HABITAT. Forest and forest edges; 350–1600 m altitude.

b. subsp. ***pusilla*** Rugayah (Fig. 3 A–J)
in Rugayah & W.J. de Wilde, Reinwardtia 11, 3 (1998) 217; Rugayah & W.J. de Wilde (1999) 251; Rugayah (1999) 79. Type: *Mogea & W.J. de Wilde* 4372, C Kalimantan (holotype BO; isotype K, L).

DISTRIBUTION. Borneo (Sarawak, Sabah, C & E Kalimantan).

HABITAT. Forest and forest edges; lowland.

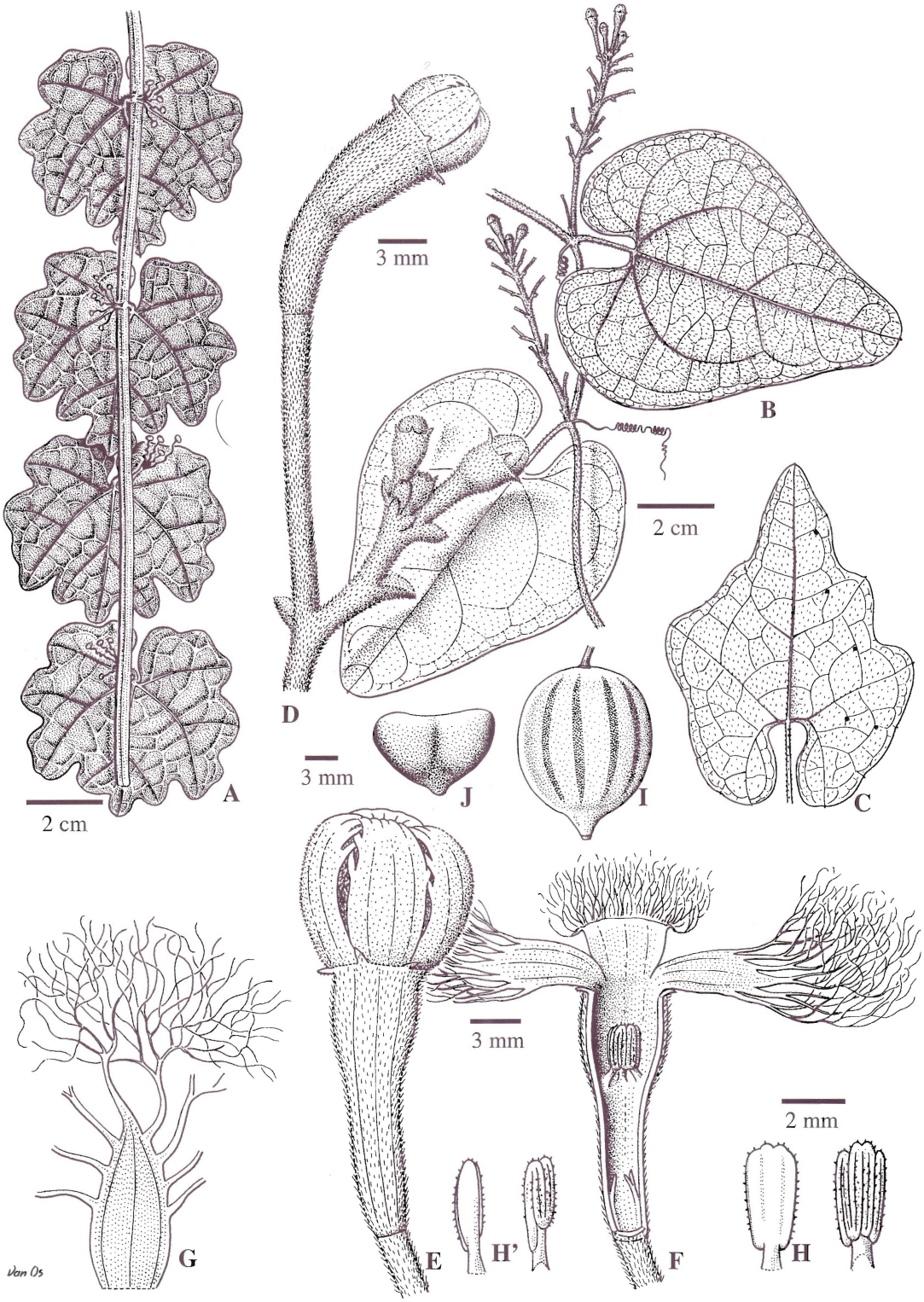

Fig. 3. *Trichosanthes beccariana* subsp. *pusilla*. **A.** Juvenile leafy twig (note adhesive discs at apex of tendrils). **B.** Male flowering leafy twig. **C.** Leaf. **D.** Part of male inflorescence. **E.** Male flower bud. **F.** Male flower opened showing disc elements and synandrium. **G.** Petal of male flower. **H.** Stamen, 2-thecous. **H'.** Stamen, 1-thecous. **I.** Fruit. **J.** Seed. A from *de Wilde, Postar & Ubaldus* SAN 144010; B–H from *de Wilde, Postar & Ubaldus* SAN 144006; I & J from *Fedilis Krispinus* SAN 95877. Drawn by Jan van Os.

4. *Trichosanthes borneensis* Cogn. in A. & C. DC., Monogr. Phan. 3 (1881) 369; Rugayah & W.J. de Wilde (1999) 251; Rugayah (1999) 135 Beaman *et al.* (2001) 210. Type: *Korthals* 54, Borneo, Kalimantan (holotype L).

DISTRIBUTION. Sumatra, Peninsular Malaysia, Borneo.

HABITAT. Open places and edges of primary and degraded forest; lowland to 900 m altitude.

Fruits from peat swamp forest in Brunei are very small, 3.8 by 5 cm.

5. *Trichosanthes cucumerina* L., Sp. Pl. (1753) 1008; Rugayah & W.J. de Wilde (1997) 478; (1999) 252; Rugayah (1999) 66. Type (C. Jeffrey 1980): *Pada valam*, p. 39, tab. 15 in Rheede, Hort. Ind. Malab. 8 (1688).

a. var. ***cucumerina***

DISTRIBUTION. Widespread; India, Sri Lanka, S China, through Malesia eastward to N Australia. No specimens seen from Sabah.

b. var. ***anguina*** (L.) Haines, Bot. Bihar Orissa (1922) 388; Rugayah & W.J. de Wilde (1997) 478; (1999) 252; Rugayah (1999) 69; Beaman *et al.* (2001) 210, as a subspecies. *Trichosanthes anguina* L., Sp. Pl. (1753) 1008; 304. Lectotype (C. Jeffrey, 1993): *'Anguina'*, Micheli, Nov. Pl. Gen.: t. 9. 1729.

DISTRIBUTION. Widespread; cultivated as a vegetable. One collection seen from Sabah, Melangkap Tomis, *Lorence Lugas* 522.

6. *Trichosanthes elmeri* Merr., Univ. Calif. Publ. Bot 15 (1929) 299; Rugayah & W.J. de Wilde (1999) 258; Rugayah (1999) 105, map 11; Beaman *et al.* (2001) 210. Type: *Elmer* 20298 Sabah (holotype PNH; isotypes BR, CANB, L, U).

DISTRIBUTION. Sumatra, Peninsular Malaysia, Borneo, Philippines.

HABITAT. Disturbed places in primary forest and forest edges; lowland up to 1100 m altitude.

7. Trichosanthes fusca *W.J. de Wilde & Duyfjes* **sp. nov.** *Trichosanthi postarii et T. auriculatae similis, in floribus masculis pilis grosse brunneis, receptaculi tubo non attenuato sub filamentorum insertione differt. Typus: Kato, Okamoto & Walujo 11279 (holotypus L)*

(Fig. 4 A–C)

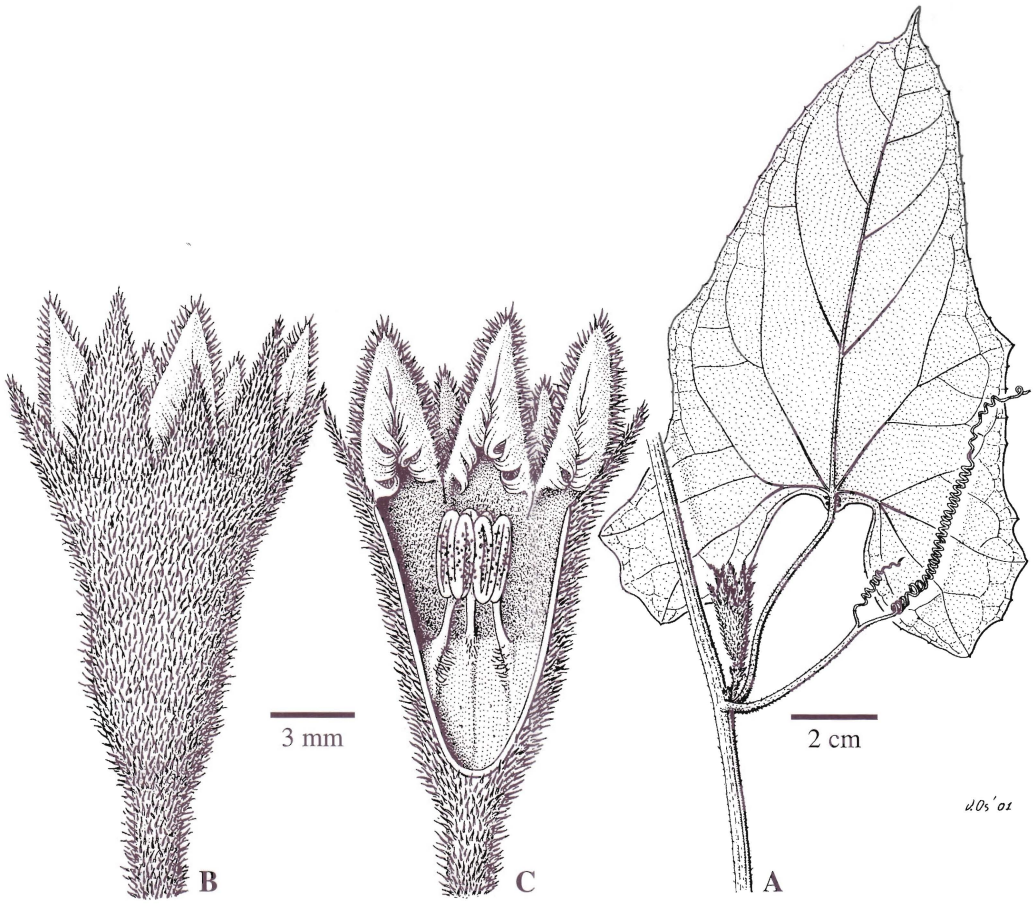

Fig. 4. *Trichosanthes fusca*. **A.** Male flowering leafy twig. **B.** Male flower bud. **C.** Male flower, opened showing stamens. All from *Kato, Okamoto & Walujo* 11279 (type). Drawn by Jan van Os.

Scrambler, size unknown; dioecious (?); wholly with sparse rusty hairs, *c.* 0.5 mm long; plant green on drying; cystoliths inconspicuous; fertile stem 4–5 mm diameter. Probract absent (or inconspicuous?). Tendrils hairy, 2-branched, at 3–4 cm from the base, main branch 10–15 cm long, the second much shorter. Leaves scabrid, simple, entire, ovate-oblong or (faintly) hastate, *c.* 15 × 8–12 cm, base deeply cordate, with at the transition to the petiole at each side a small shallowly bulging faint auricle, apex acuminate-mucronate, margin irregularly shallowly lobulate-dentate or sinuate; glands on blade absent or abaxially few and very minute, but each (faint) auricle with 1–3 crowded glands; basal nerves 5. Male inflorescence with a single flower, terminal of a short branch 1–1.5 cm long with a few scattered bracts 2–3 mm long, conspicuously densely harshly hairy, hairs *c.* 1 mm long, dark rusty-brown, the inflorescence co-axillary with the initial of a lateral sterile shoot or possibly a male raceme. Male flower (mature bud): pedicel *c.* 6 mm long; receptacle-tube long-cup-shaped, slightly more narrowed in the lower half, *c.* 10 mm long, at throat *c.* 8 mm

wide; sepals long-triangular, *c.* 8 mm by 1 mm at base; petals in bud folded into a conical body with free apices, at anthesis presumably *c.* 8 × 6 mm, excluding *c.* 10 mm long threads; synandrium included, subtruncate at both ends, *c.* 4 × 3.5(–4) mm, consisting of 3 free anthers, tightly appressed, but not fused, two 2-thecous, one 1-thecous; thecae sigmoid; filaments *c.* 1mm long, slender, terete, inserted halfway the tube where passing into strongly brown hairy thickenings of the tube *c.* 2 mm long; 'diaphragm' absent (see note); disc absent. Female flowers and fruits unknown.

DISTRIBUTION. Kalimantan, Mount Buduk Rakit, north of Long Bawan, Krayan, 115° 47' E, 4° 3' N. This location is close to the Sabah border.

HABITAT. On gravel river bank, 1200 m altitude. Flowering in August.

Trichosanthes fusca merits description even on rather scrappy material, because its flower is quite unique. It seems most related to *T. postarii* and more distantly to *T. auriculata*. All three species are similar in leaves having two, more or less well-developed auricles, with small glands inside, at both sides of the blade base at the transition to the petiole. *Trichosanthes fusca* lacks the 'annulus', a narrowing in the receptacle-tube below the insertion of the filaments as present in both *T. auriculata* and *T. postarii*; the three species are here placed in the new section *Asterosperma*.

Clemens 21110 (sterile, BO) from Sarawak, Kapit, upper Rejang River, obviously belongs to sect. *Asterosperma*; it differs in having much coarser, brittle stiff hairs and cystoliths all over, and may represent a fourth species in this section. SAN (*Postar et al.*) 144100, sterile, from Luasong, possibly belongs here as well.

8. *Trichosanthes globosa* Blume, Bijdr. Fl. Ned. Ind. (1826) 936; Rugayah & W.J. de Wilde (1997) 478; (1999) 260; Rugayah (1999) 140, pl. 16. Type: *Blume s.n.*, Java (holotype L, Herb. Lugd. Bat. 901288620; isotypes BR, P).

Involucraria globosa (Blume) M.J. Roemer, Syn. Fasc. 2 (1846) 99.

DISTRIBUTION. Sumatra, Java, Borneo.

HABITAT. Lowland primary and degraded forest.

9. Trichosanthes intermedia *W.J.de Wilde & Duyfjes* **sp. nov.** *Trichosanthi longispicatae similis, in foliis minoribus, pedicellis masculis bracteis brevioribus differt. Typus: Wood SAN 16077 (holotypus SAN; isotypi A, BO, BRI, K, KEP, L, SING).*

(Fig. 5 A–F; Fig. 6 A–F)

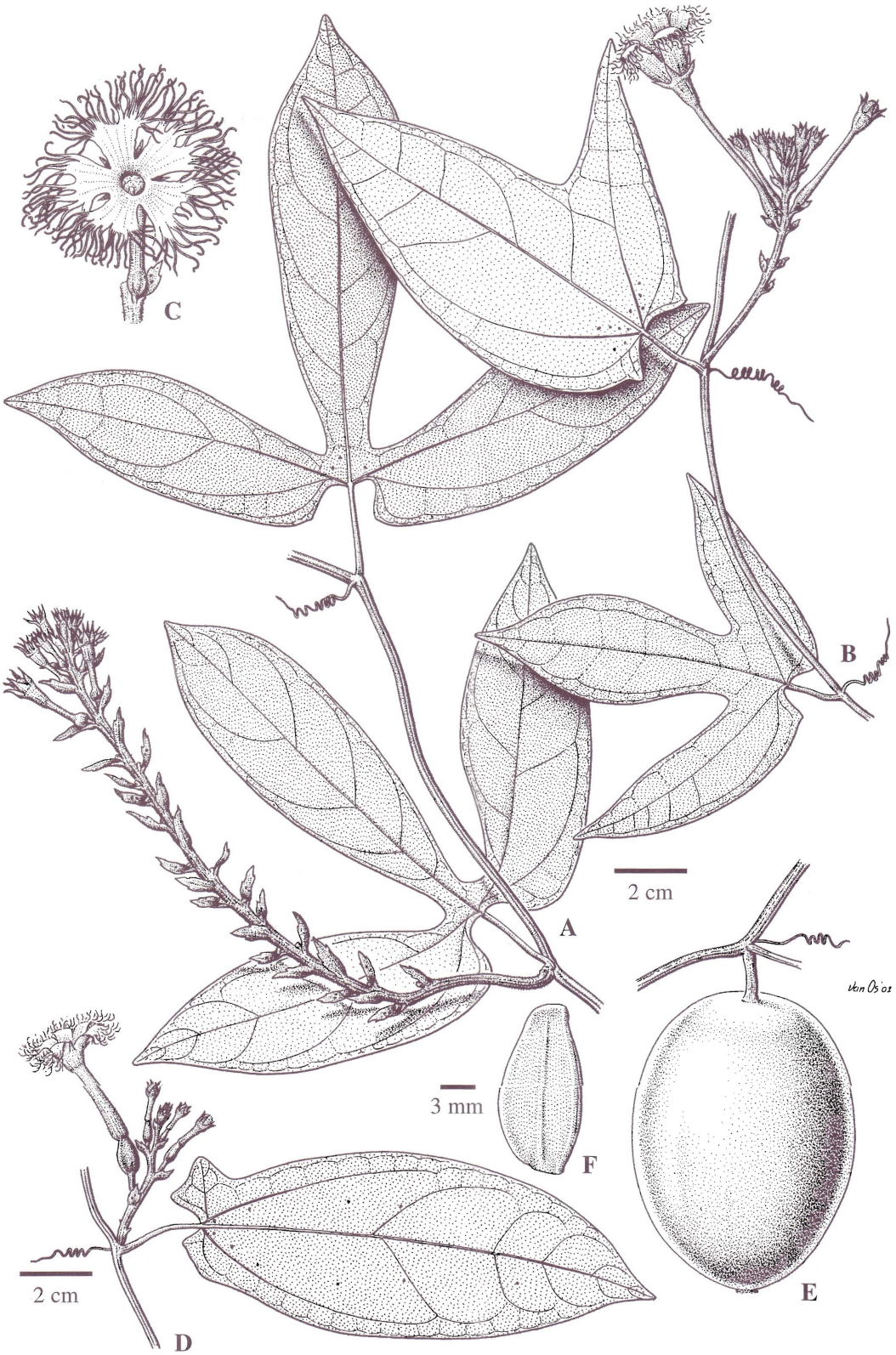

Fig. 5. *Trichosanthes intermedia*. **A.** & **B.** Male flowering leafy twigs (note flowers with pseudo ovaries). **C.** Male flower. **D.** Female flowering leafy twig. **E.** Twig with fruit. **F.** Seed. A from *de Wilde* SAN 116493; D from *de Wilde & Postar* SAN 141936; E & F from *Lassan & Ampon* SAN 71525. Drawn by Jan van Os.

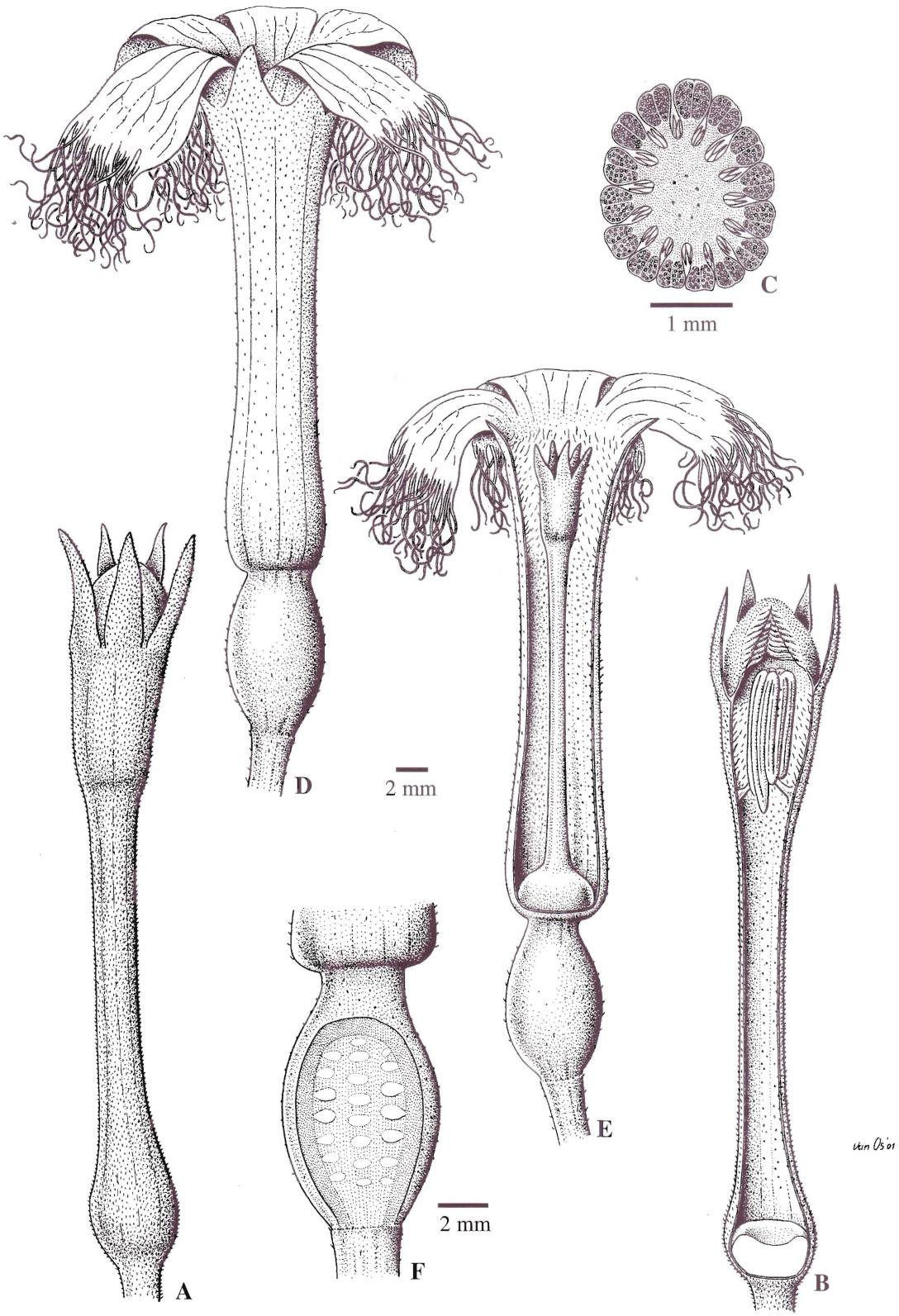

Fig. 6. *Trichosanthes intermedia*. **A.** Male flower bud. **B.** Male flower, opened (note synandrium and semiglobose disc at base). **C.** Cross section of synandrium. **D.** Female flower. **E.** Female flower, opened. **F.** Female flower, showing ovary at longitudinal section. A–C from *Asik Mantor* SAN 115882; D–F from *de Wilde & Postar* SAN 141936. Drawn by Jan van Os.

Trichosanthes sp. 2, Beaman *et al.* (2001) 212.

Small subherbaceous liana, 2–8 m long; dioecious or monoecious; wholly with minute hairs (except inflorescences), early glabrescent; brown-green on drying; cystoliths abundant, but small; fertile stem 1.5–3.5 mm diam. Probract absent or very small. Tendrils subglabrous, 10–12 cm long, simple or rarely 2-branched, at *c.* 2 cm from the base. Leaves faintly scabrid, simple, entire or 3(–5)-lobed, occasionally to the base (never foliolate with petiolules as in *T. wawrae*), ovate-oblong or when lobed subcircular in outline, 8–15 × 4–7(–19) cm, base cordate, apex of lobes acute-acuminate, margin entire; glands abaxially, several to many, small, scattered; basal nerves 3(–5). Inflorescences either all(?) racemes male, or racemes of male flowers mixed with some female flowers, or female flowers single on the nodes; racemes 1–3.5 cm long; peduncle 5–20 cm long, wholly densely pubescent, especially bracts and flowers, hairs 0.1 mm long, brown. Male raceme rachis 2–3 mm thick; 5–40-flowered; bracts ovate(-oblong), 6–15 mm long, coarsely dentate, apex acute, persistent, abaxially with several to many glands. Male flower pedicel ± half as long as the sustaining bract, 3–6 mm long, at apex ± articulate, persistent; receptacle-tube slender, 30–40 mm by 2–3(–5) mm, dilated in the upper 8–9 mm, at throat 6–7 mm wide, at base broadened into a semiglobose 'pseudo ovary' 3–5 mm diam. on drying (see below); sepals oblong-lanceolate, 6–8 × 2–2.5 mm, entire, acute; petals ± obdeltoid, including *c.* 10 mm long threads *c.* 20 mm long; tube inside in upper part sparingly woolly hairy, hairs *c.* 1 mm long, pale, the lower and narrower part with sparse dark glandular hairs, *c.* 0.1 mm long; synandrium slightly exserted, truncate at apex, ± narrower at base, and entering into the narrowed portion of the receptacle-tube, *c.* 9 × 3.5 mm; anthers completely fused; filaments glabrous, *c.* 1 mm long, inserted *c.* 5 mm below receptacle-throat (attached to synandrium well above its base); disc conspicuous, at base of tube, a thick carnose, semiglobose cushion ± depressed at apex, *c.* 3 × 3–4 mm, largely fused with the receptacle-tube, in dry specimens causing the 'pseudo ovary' (see note). Female flower resembling male; pedicel 6–10 mm long, ovary (sub)glabrous, *c.* 9 by 5 mm, receptacle-tube *c.* 30 mm long; sepals narrow, *c.* 5 mm long; expanded corolla c. 30 mm wide; style and stigma not investigated. Fruit mostly solitary (rarely 2 or more?), ovoid, 7–9 × 6–7 cm, green or red; pericarp when fresh 5(–10) mm thick, much thinner when dry; fruiting pedicel 1.5(–4) cm by 3 mm. Seeds brown, numerous, elliptic-oblong, truncate-rounded at one side, flat, *c.* 15(–20, see note) by 7–9 mm, with a narrow margin and a low ridge in the middle.

DISTRIBUTION. Endemic to Sabah.

HABITAT. Open forest, forest edges, often on damp sites, 0–1300 m altitude. This species starts flowering already in the late afternoon.

SPECIMENS EXAMINED—BORNEO. SABAH: Lahad Datu Distr.: Lahad Datu, *Wood* SAN 16077 (fr., March) (Type); Kunak, Forest Education Park, *de Wilde, Postar et al.* SAN 141936 (♀, immature fr., Jan.). Tawau Distr.: Luasong, *Krispinus* SAN 87364 (♂, Aug.). Kinabatangan Distr.: MaliauValley, *Pereira et al.* SAN 151229 (immature fr.); Sg. Pingas

Pingas, *Asik Mantor* SAN 115882 (♂, May); Tongod, *Patrick & Kumin* SAN 93578 (♂, March). Keningau Distr.: Trusmadi, *Bousi et al.* SAN 123992 (♂, May). Pensiangan Distr.: Pensiangan Kayu FR, *Krispinus* SAN 130111 (♂, July). Sandakan Distr.: Sepilok FR, *de Wilde* SAN 116493 (♂, Feb.); *de Wilde* SAN 141919 (♂, Jan.); *Singh* SAN 22565 (sterile Aug.); *Lassan & Ampon* SAN 71525 (fr., May). Kota Belud Distr.: Mount Kinabalu, E Shoulder, 4000 ft., *Chew, Corner & Stainton* RSNB 1204 (fr., July); Mount Kinabalu, 3000 ft., *J. & M.S. Clemens* 26116A (sterile).

Trichosanthes intermedia resembles and can be confused with *T. wawrae, T. longispicata* and *T. refracta*. The latter, a species from peaty forest in Brunei and Philippines, differs in sinuate male racemes and lack of glands on the bracts. *Trichosanthes longispicata* from Sarawak is very similar, but much stouter, and differs in e.g. larger 5–7-lobed leaves and male pedicels about as long as the bracts. *Trichosanthes wawrae* (Peninsular Malaysia, Sumatra, W Java, not known with certainty from Sabah) resembles only superficially: its leaves may be entire, lobed or compound, the leaflets distinctly petioluled, its male racemes are very similar, but generally more slender and the male flowers lack the 'pseudo ovary', its seeds are generally broader. The phenomenon of a 'pseudo ovary' in male flowers is caused by the presence of a thick cup- or cushion-shaped disc at the bottom of the receptacle-tube, and becomes visible on drying, resembling an ovary, which in the female flowers, of course, is inferior, below the receptacle-tube. A 'pseudo ovary' occurs also in *T. longispicata, T. refracta*, and in the non-related *T. villosa*.

Chew, Corner & Stainton RSBN 1204 (Kinabalu) differs in having a long, fruiting pedicel, *c.* 4 cm long, and larger seeds, *c.* 2 cm long. The stout male racemes of *Asik Mantor* SAN 115882 equal those of *T. longispicata* in length.

10. *Trichosanthes kinabaluensis* Rugayah in Rugayah & W.J. de Wilde, Reinwardtia 11, 4 (1999) 262, nom. inval.; Rugayah (1999) 90, pl. 2; (2000) 419; Beaman *et al.* (2001) 211, pl. 16: D–E. Type: *Chew, Corner & Stainton* RSBN 2830 (holotype BO; isotypes K, L, SAN).

DISTRIBUTION. Endemic to Sabah (Kinabalu and northern Crocker Range area).

HABITAT. Moist places in secondary roadside vegetation, forest and scrub edges, 1000–1600 m altitude.

The fruits, when ripe, are bright orange and paler speckled.

11. Trichosanthes montana *Rugayah* **subsp. crassipes** *W.J. de Wilde & Duyfjes* **subsp. nov.** *A subspecie typica in fructu globoso ad depresse globoso clare rubro, pedicello frutescenti 1.5–2 cm crasso cortice profunde fissurato suberoso differt. Typus: de Wilde, Tajuddi and Good SAN 143916, Tongod, Imbak river (holotypus SAN; isotypus L).*

Trichosanthes montana Rugayah, Beaman *et al.* (2001) 211, pl. 16: F.

Climber to 12 m; dioecious; early glabrescent, at first brown puberulous with hairs to 1 mm long; brown on drying; cystoliths not obvious; fertile stem *c.* 5 mm diam. Probract ± membranous, elliptic or oblong, 5–10(–15) mm long, glands absent. Tendrils 2–4-branched. Leaves simple, deeply 5–7-lobed, membranous, chartaceous, or subcoriaceous, not or little scabrous, often finely bullate adaxially, circular in outline, 10–28 × 11–26 cm, base cordate, apex of lobes acute-acuminate, margin entire; glands absent or few near the base, 1–3 mm diam. Male raceme 15–40 cm long, brown pubescent; peduncle 2–6 cm long, 5–7 mm thick; rachis thick, *c.* 10 mm diam., densely set with (scars of) bracts and flowers, 20 or more; bracts subcoriaceous, rhomboid or broadly obovate, 45–60 × 20–30 mm, coarsely dentate, persistent or late caducous; glands not obvious. Male flower pedicel 3–5 mm long, caducous; receptacle-tube 30–45 mm long, at apex 7–8(–10) mm wide; sepals triangular-lanceolate, 10(–17) mm long, 3–4 mm wide at base, margin entire or with few lobes; petals obovate-rhomboid, *c.* 20 mm long, threads 5–10 mm long; synandrium 12–15 mm long; filaments 3–4 mm long, pubescent, inserted *c.* 15 mm below throat; disc close to the base of the receptacle-tube, consisting of 3 transverse pads. Female flower pedicel 15–20 mm long; ovary ovoid or subglobose, 10 mm diam., sparsely short brown pubescent; receptacle-tube and perianth as in male. Fruit (depressed)globose, apex rounded, red; pericarp firm-fleshy, when dry *c.* 15 mm thick, exocarp woody, *c.* 1 mm thick, smooth, pulp greenish black; fruiting pedicel *c.* 3 cm long, 15–20(–25) mm thick, with coarsely and deeply fissured corky bark. Seeds brown-black, flat, ovate-oblong 17–20 × 6–8 mm, 2–3 mm thick, apex and base narrowly rounded, margin faint, edge entire.

DISTRIBUTION. Known only from Sabah and E Kalimantan.

HABITAT. Roadside vegetation and forest edges, 100 to 1600 m altitude.

SPECIMENS EXAMINED—BORNEO. SABAH: Kota Belud Distr.: Kinabalu, *J. & M.S. Clemens* 28866; 29041B; 34152; *de Wilde* 21950B (sterile); 21953 (fr.); 21997; (sterile); 21998 (♀); *Amin et al.* SAN 118232 (fr.); *Postar et al.* SAN 144255; 144258; 144259; *Sugau* JBS 106 (fr); 113 (fr.). Sipitang Distr.: Long Pasia, *Lim & Postar* SAN 143277 (fr.). Kinabatangan Distr.: Melikop, *de Wilde, Postar & Ubaldus* SAN 144008 (♂); 144009 (♀, fr.); Tongod, *Von der Hyde & Company* s.n. (fr.); Imbak River, *de Wilde, Tajuddin & Good* SAN 143916. Labuk Sugut Distr.: Lungmanis FR., *de Wilde & Postar* SAN 141908 (fr.). Tawau Distr.: Tawau Hill FR, *de Wilde, Postar & Pereira* SAN 141925 (fr.).

New fruiting, male and female flowering collections made it clear that two subspecies can be recognized; both are vegetatively similar. In subsp. *montana* (partly monoecious) the fruiting pedicels of solitary fruits are longer, not or only shallowly fissured; the fruits ±

short-ellipsoid and (greenish) orange when ripe. The fruits of subspecies *crassipes* are borne always single on the nodes, (depressed) globose, and bright red when ripe, with short and very thick fruiting pedicel with a conspicuously deeply fissured brown corky surface.

The leaves of *T. montana* are similar to those of *T. longispicata* (W Sarawak), a species different in male inflorescences. The fruiting collections from Sabah cited with the description of *T. longispicata* (Rugayah & de Wilde, 1997, 1998; Rugayah 1999) are now relegated to *T. montana* subsp. *crassipes*.

12. *Trichosanthes mucronata* Rugayah in Rugayah & W.J. de Wilde, Reinwardtia 11(4) (1999) 268; Rugayah (1999) 80, pl. 1; Beaman *et al.* (2001) 211, pl. 17: A–B. Type: *W.J. de Wilde & Duyfjes* SAN 139464, Sabah (holotype SAN; isotypes BO, L).

DISTRIBUTION. Endemic to Sabah (Mount Kinabalu area, vicinities of Tenompok).

HABITAT. Wet places in forest edges and shrubby roadsides, 1000–1400 m altitude.

13. *Trichosanthes obscura* Rugayah in Rugayah & W.J. de Wilde, Reinwardtia 11(4) (1999) 269; Rugayah (1999) 92, pl. 13. Type: *Hansen* 968, Sarawak (holotype L; isotypes C, S).

DISTRIBUTION. Borneo (Sarawak, Brunei, Sabah, Kalimantan).

HABITAT. Mixed forest, riversides, low altitudes.

14. *Trichosanthes ovigera* Blume, Bijdr. Fl. Ned. Ind. (1826) 934; Rugayah & W.J. de Wilde (1997) 478; (1999) 269; Rugayah (1999) 72; Beaman *et al.* (2001) 211. Type: *Blume s.n.*, Java (holotype L, Herb. Lugd. Bat. 90128912; isotype P).

DISTRIBUTION. Widespread, SE Asia through Malesia to N Australia; in Sabah known from two collections: Labuk Sugut, Kg. Kapuakan, *Aban & Dewol* SAN 96621 and Menggis Rasak, *Matamin Rumutom* 173.

HABITAT. Primary and secondary forest edges, lowland and medium altitudes.

15. *Trichosanthes pendula* Rugayah in Rugayah & W.J. de Wilde, Reinwardtia 11(3) (1998) 219, fig. 1, 2, 3; Rugayah & W.J. de Wilde (1999) 271; Rugayah (1999) 83. Type: *Joseph B. et al.* SAN 120771, Sabah (holotype SAN; isotypes KEP, L).

DISTRIBUTION. Endemic to E Sabah; known only from Sepilok, Maliau Valley and Melikop.

HABITAT. Primary lowland forest.

16. Trichosanthes postarii *W.J. de Wilde & Duyfjes* **sp. nov.** *Liana. Laminae basi auriculis 2 concavis intra glandibus gaudet. Inflorescentiae cauliflorae atro-ferruginee pubescenti. Receptaculi tubus urceolatus c. 15 mm longus, antherae appressae liberae. Typus: Postar et al. SAN 144066 Sabah, Maliau Valley (holotypus SAN; isotypus L).*

(Fig. 7 A–J'; Fig. 8 A–D)

Trichosanthes sp. 1, Beaman *et al.* (2001) 212, pl. 17: C.

Much branched spacious liana, 10–20 m long; dioecious; wholly with short scabrous pale brown hairs, *c.* 1 mm long; green on drying; leafy stem *c.* 5 mm diam. Probract absent. Tendrils finely harshly hairy, 2-(or 3-)branched, at 1–2(–3) cm from the base, 10–15 cm long. Leaves finely scabrid, with scattered hairs *c.* 2 mm long, cystoliths often present, simple, subentire or in juvenile or shooting leaves 5-angular or -lobed *c.* 1/4 deep, ovate-oblong, 9–22 × 6–13 cm, base deeply cordate, at each side with a small bulging auricle at the transition to the petiole, 3–4 mm diam., each inside with 3–5 crowded glands, apex acute-acuminate, margin finely or coarsely dentate, the teeth at apex 0.5–1 mm long with a dark coloured point; glands abaxially, small, mostly many, scattered; basal nerves 5(–7). Inflorescences on leafless shoots hanging down close to the forest floor. Male inflorescence 1 or 2 (or 3) racemes, fascicled, horizontal or drooping; tendril reduced or withered; raceme, including 0.5–1 cm long peduncle, 5–13 cm long, wholly densely hairy, hairs 0.2–0.5 mm long, dark rusty; rachis slender, 1(–1.5) mm thick, 10–20-flowered; bracts and pedicels usually persistent, bract 1–3 mm connate with pedicel, oblong, 5–8 mm long, coarsely shallowly dentate, adaxially with several conspicuous glands near the margin. Male flower pedicel persistent, 6–10 mm long, faintly articulate *c.* 2 mm below apex; receptacle-tube ± urceolate, inside glabrous, 15(–20) mm long, at throat 6(–8) mm wide, consisting of a ± campanulate upper half and a swollen lower half, inside demarcated by a diaphragm-like raised rim; sepals (long-)triangular, 2–3 mm long; petals in bud folded into a ± conical body with free apices, at anthesis including 6–8 mm long threads 16–18 mm long; synandrium included, truncate, *c.* 3.5 × 2.5 mm; anthers (two 2-thecous and one 1-thecous) free, tightly appressed but not fused, thecae sigmoid; filaments inserted halfway on the receptacle-tube where it is ± contracted, glabrous with few hairs on thickened base; disc absent. Female flower 1 or 2 in short raceme; pedicel *c.* 10 mm long; ovary subglabrous; receptacle tube *c.* 12 mm long; sepals triangular, *c.* 2 mm long; style and stigma not investigated. Fruit on leafless shoots, 1 or 2 per infructescence, oblong, 13–16 × 4.5–5.5 cm, base subobtuse, apex acute, green, white striped; pericarp thin, pulp white, bitter; fruiting pedicel 2.5–3 cm × 4–5 mm. Seeds brown, numerous, flat, circular in outline, *c.* 10 mm diameter, with broad radiating ribbed margin.

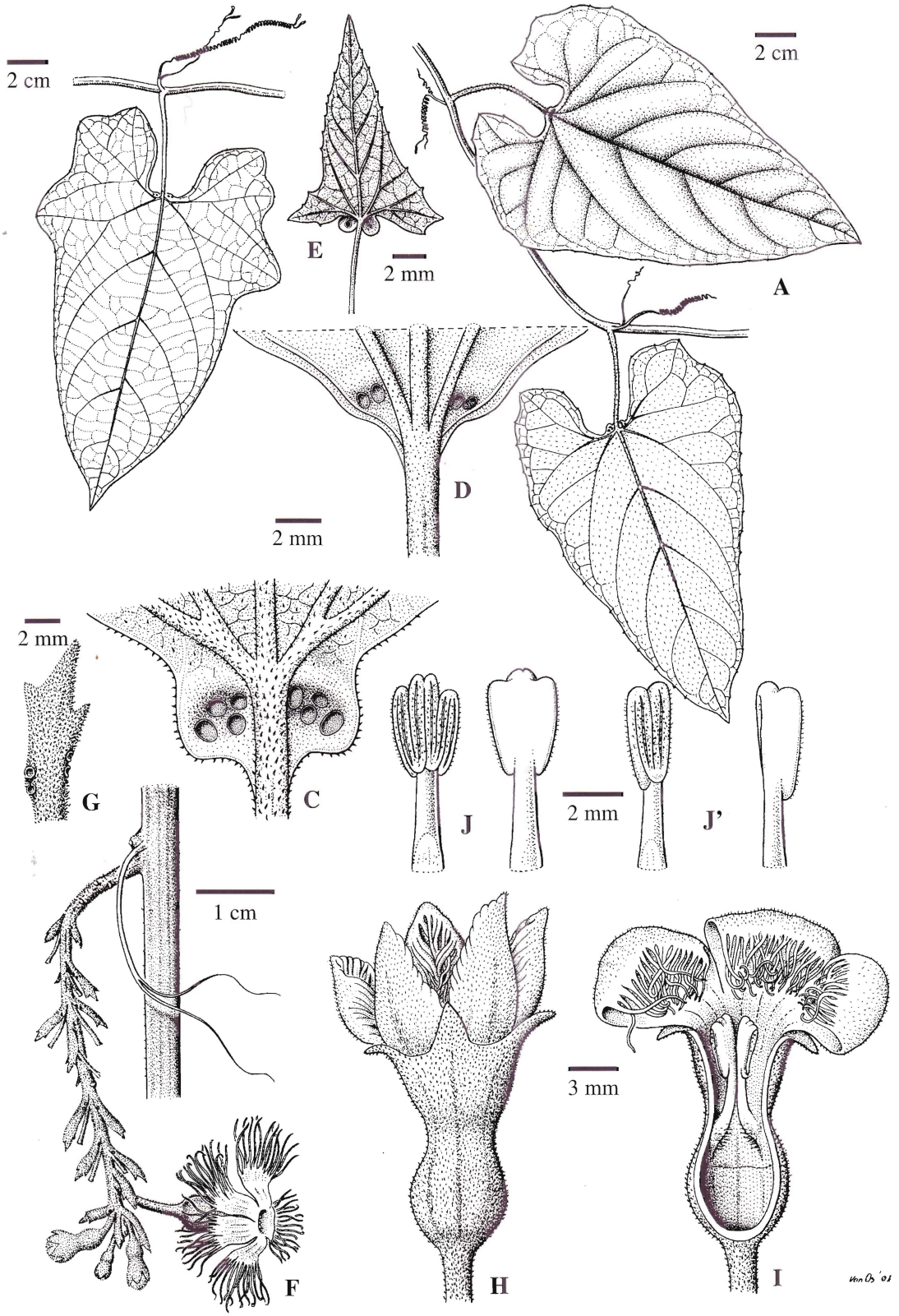

Fig. 7. *Trichosanthes postarii*. **A.** & **B.** Leafy twigs. **C.** & **D.** Base of leaf blades showing auricles (note glands on lower surface). **E.** Young developing leaf. **F.** Male flowering twig. **G.** Male bract. **H.** Male flower. **I.** Male flower showing stamens. **J.** Stamen, 2-thecous. **J'.** Stamen, 1-thecous. All from *de Wilde & Duyfjes* SAN 139470. Drawn by Jan van Os.

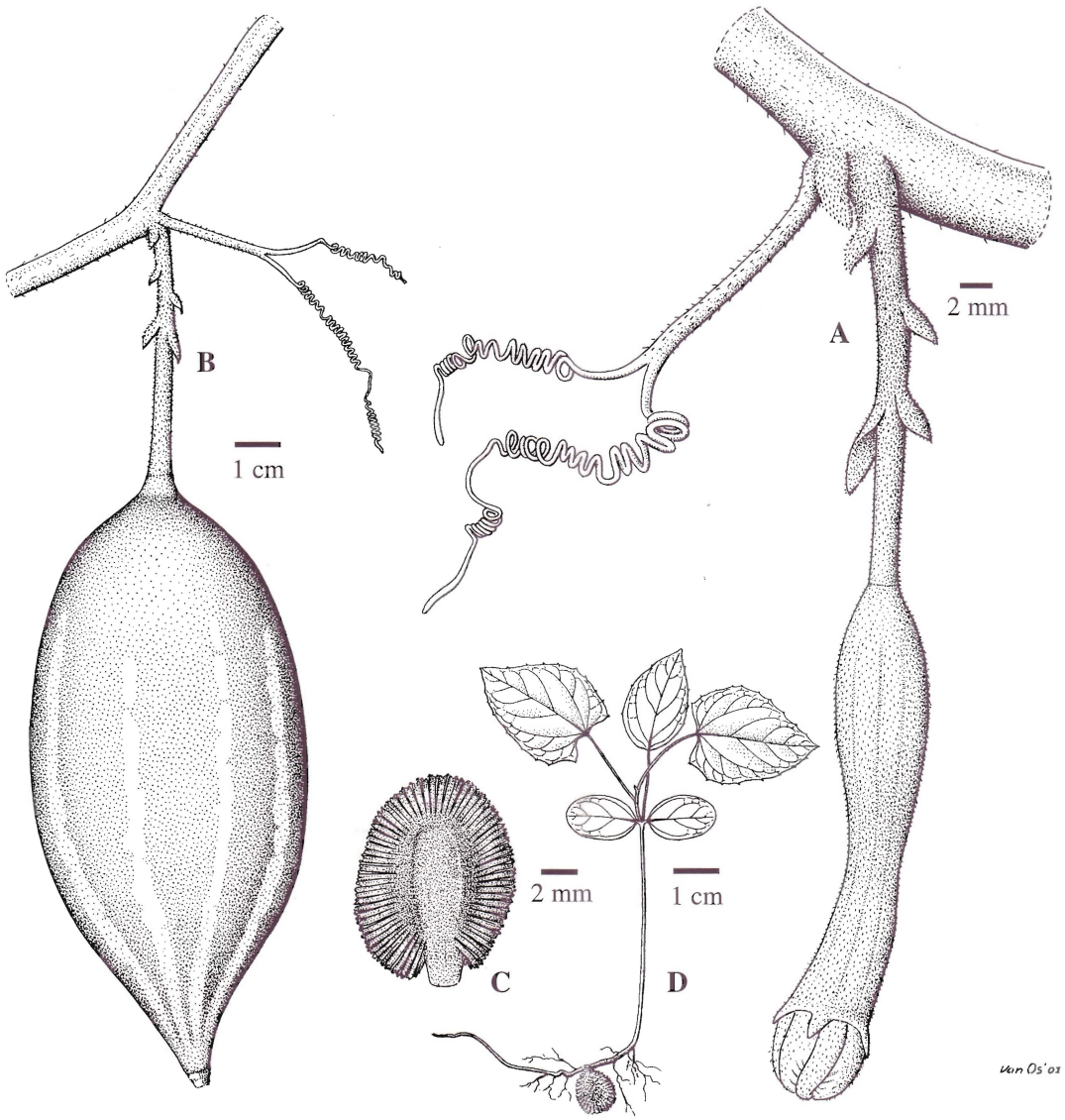

Fig. 8. *Trichosanthes postarii*. **A.** Female flowering twig. **B**. Twig with infructescence. **C.** Seed. **D.** Seedling. A, C & D from *Postar, Ubaldus & de Wilde* SAN 144110; B from *Postar, Ubaldus & de Wilde* SAN 144066 (type). Drawn by Jan van Os.

DISTRIBUTION. Endemic to Sabah. Fertile specimens known only from Poring, Langanan Waterfall, *c.* 1300 m altitude, and Maliau Valley; sterile collections from several localities at 50–200(–500) m altitude.

HABITAT. A species of primary forest and stony slopes with half open forest, wet soil; 50–1300 m altitude. Flowering in July, December and fruiting in July.

Fig. 9. Fruit of *Trichosanthes postarii*. (Photo: de Wilde)

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau Distr.: Langanan Waterfall, *de Wilde* SAN 139470 (♂); *de Wilde, Postar, Ubaldus, Selamat* SAN 144020 (♂). Labuk Sugut Distr.: Lungmanis FR, *de Wilde, Lim, Postar* SAN 141907 (sterile). Sandakan Distr.: Sepilok FR, *de Wilde, Postar* SAN 141914 (sterile); *Postar et al.* SAN 151204 (sterile). Tawau Distr.: Luasong, Ikea planting area, *Postar et al.* SAN 144098 (sterile). Tawau Hill Park, *de Wilde, Pereira, Postar* SAN 141924 (sterile). Kinabatangan Distr.: Maliau Valley, *Postar et al.* SAN 144110 (seedlings); *Postar et al.* SAN 144066 (fr) (type); Imbak River Camp, *de Wilde, Postar* SAN 143971 (sterile). Kota Marudu Distr.: Malangkap Tomis, W side Mount Kinabalu, *Lorence Lugas* 1572 (sterile) (K).

Pendulous shoots that are mostly without leaves but with only flowers are found in the shady zone near the forest floor. Sterile shoots often creep for some distance over the ground. The single or usually 2 (or 3) male racemes at a node indicate that these racemes actually are borne on a very short shoot, similar to that in *T. pendula*. In most *Trichosanthes* species there is only one single male raceme at a node, with or without a single co-axillary male flower.

17. *Trichosanthes pubera* Blume, Bijdr. Fl. Ned. Ind. (1826) 936; Rugayah & W.J. de Wilde (1997) 479, fig. 1c, 2c, 3c; (1999) 273; Rugayah (1999) 117, map 14. Type: *Blume s.n.*, Java (holotype L, Herb. Lugd. Bat. 90128930; isotype P).

DISTRIBUTION. Widespread in W Malesia; in Sabah known only from one collection, MaliauValley, *Postar et al.* SAN 143747.

HABITAT. Moist forest edge at riverside, *c.* 300 m altitude.

18. *Trichosanthes quinquangulata* A. Gray, Bot. Un. St. Exol. Exped. 1 (1854) 645; Rugayah & W.J. de Wilde (1997) 479, fig. 1a, 2a, 3a; (1999) 273; Rugayah (1999) 130, pl 3; Beaman *et al.* (2001) 212. Type: *Wilkes s.n.*, Mangsi I., Sulu Sea (holotype GH-A).

DISTRIBUTION. Widespread in Malesia.

HABITAT. Secondary and disturbed forest edges, sea-level to 1250 m altitude. Flowering and fruiting the year round.

Specimens from Sabah, especially those from limestone or ultrabasic, somewhat differ from *T. quinquangulata* found elsewhere in having a more elongate, oblong probract, *c.* 1.5 cm long.

19. *Trichosanthes sepilokensis* Rugayah in Rugayah & W.J. de Wilde, Reinwardtia 11(4) (1999) 275; Rugayah (1999) 146; Beaman *et al.* (2001) 212. Type: *de Wilde & Duyfjes* SAN 139042 (holotype SAN; isotype L).

DISTRIBUTION. Endemic to Sabah: (Sepilok area and MaliauValley).

HABITAT. Climber in tall primary forest trees, where flowering and fruiting occur high-up in the canopy, low altitudes. Flowering in Jan.–Feb. and fruiting in Jan.–Feb. & July.

Fruits are bright red when ripe. In the Maliau Valley, this climber was found with ripe fruits on a fallen tree bordering an old logging road. The fruits were assumed to be eaten by *banteng* based on footprints found near the area.

20. *Trichosanthes villosa* Blume, Bijdr. Fl. Ned. Ind. (1826) 934; Rugayah & W.J. de Wilde (1997) 481; (1999) 278; Rugayah (1999) 152. Type: *Blume s.n.*, W Java (holotype L, Herb. Lugd. Bat. 90128956; isotype P).

subsp. ***villosa***; Beaman *et al.* (2001) 212.

DISTRIBUTION. Widespread in West Malesia, also recorded for China.

HABITAT. Roadside vegetation and forest edges. In Sabah found in Tawau at 400 m and Mount Kinabalu area (Tenompok) at 1500 m altitude.

In the sterile condition, subsp. *villosa* is very similar to *T. mucronata*. They can be distinguished by the length of the portion of the tendril below the point of branching, 1–2 cm in subsp. *villosa* and 2.5–6 cm in *T. mucronata*.

21. *Trichosanthes wawrae* Cogn. in A. & C. DC., Mon. Phan. Prodr. 3 (1881) 384 ('*wawraei*'); Rugayah & W.J. de Wilde (1997) 481; (1999) 279; Rugayah (1999) 108, map 12. Type: *Wawra* 241, Singapore (holotype W).

forma ***wawrae***

DISTRIBUTION. Sumatra, Peninsular Malaysia, Singapore, Borneo, W Java.

HABITAT. Primary and degraded forest, lowland up to 1700 m altitude. In Sabah, it is known only from Kinabalu Park (a doubtful record sterile material). The foliolate leaves, however, makes it likely that *T. wawrae* occurs in that area.

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